

Relating the STANDARD & FACTORED Forms

Factored Form: $y = a(x-s)(x-t)$
 → direction of opening, zeros

$a > 0$ → opens up
 $a < 0$ → opens down

Standard Form: $y = Ax^2 + Bx + C$
 → direction of opening, y-intercept

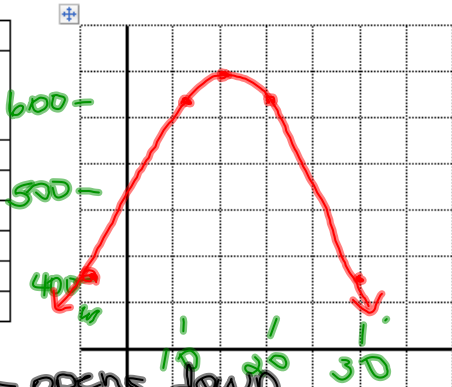
Zeros of a Relation: x-intercepts. The y are the place where the graph crosses the x-axis. These can be seen in an equation in ff

Example #1: Connecting the standard and factored forms of quadratic functions.

Consider the two functions: $f(x) = (40 - x)(10 + x)$ and $f(x) = -x^2 + 30x + 400$

i) Compare the two functions by graphing using a table of values.

x	$f(x) = (40 - x)(10 + x)$	$f(x) = -x^2 + 30x + 400$
0	$f(0) = (40)(10)$ $f(0) = 400$	400
5	$(35)(15) = 525$	525
10	600	600
15	625	625
20	600	600
25	525	525
30	400	400



Factored form Standard form

Identical graphs

- opens down
 - V(15, 625)

ii) Compare the two functions algebraically. Find the zeros of the relations.

$$f(x) = (40 - x)(10 + x)$$

$$\begin{aligned} f(x) &= 400 + 40x - 10x - x^2 \\ &= 400 + 30x - x^2 \\ &= -x^2 + 30x + 400 \end{aligned}$$

Find zeros

$$\begin{aligned} f(x) &= (40 - x)(10 + x) \\ 0 &= (40 - x)(10 + x) \\ x &= 40, -10 \end{aligned}$$

Example #2: Factoring to determine the vertex of a quadratic function.

Find the coordinates of the vertex of $f(x) = 2x^2 - 5x - 12$. Sketch the graph of $f(x)$.

① Find zeros—change the equation into ff

$$2x^2 - 5x - 12 \quad \begin{array}{l} x-24 \\ + -5 \\ \hline -8, 3 \end{array}$$

$$2x^2 - 8x + 3x - 12$$

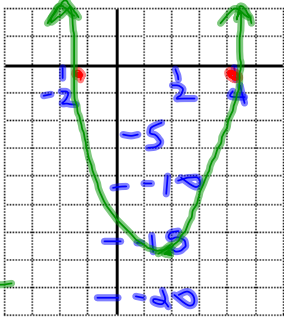
$$2x(x-4) + 3(x-4) \checkmark$$

$$(2x+3)(x-4) = f(x)$$

zeros $\rightarrow 4, -3/2 \rightarrow 4, -1.5$

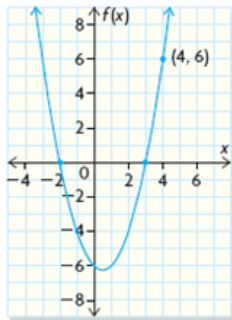
$2x+3=0$
 $2x=-3$
 $x=-1.5$

$y_{\text{vertex}} = \frac{4-1.5}{2}$
 $x_{\text{vertex}} = 1.25$
 $y_{\text{vertex}} = 2(1.25)^2 - 5(1.25) - 12$
 $= 3.125 - 6.25 - 12$
 $= -15.125$



Example #3: Finding a quadratic function in factored & standard forms from a graph.

From the graph of the quadratic function, determine the function's *factored* and *standard* forms.



$$f(x) = a(x-s)(x-t)$$

$s, t = \text{zeros}$

zeros $= -2, 3$

$$f(x) = a(x+2)(x-3)$$

$$6 = a(4+2)(4-3)$$

$$6 = a(6)(1)$$

$$6 = 6a$$

$$\frac{6}{6} = \frac{6a}{6}$$

$$1 = a$$

$\therefore y = 1(x+2)(x-3)$ factored form

Standard form

$$y = x^2 - 3x + 2x - 6$$

$$y = x^2 - 1x - 6$$

standard form $\xleftrightarrow[\text{FACTOR}]{\text{EXPAND}}$ factored form